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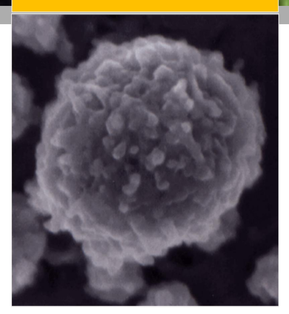


Casein micelles as encapsulating material and delivery system for JABUTICABA EXTRACT

Martins E.; Nascimento L.G.L.; Casanova F.; Silva, N.F.N.; Carvalho, A.F.

INTRODUCTION

50% Fruit peel and seed

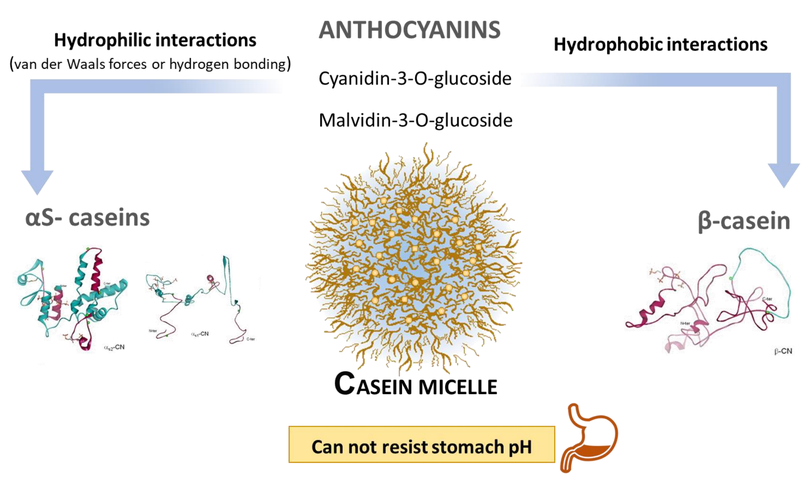
8.5 % POLYPHENOLS

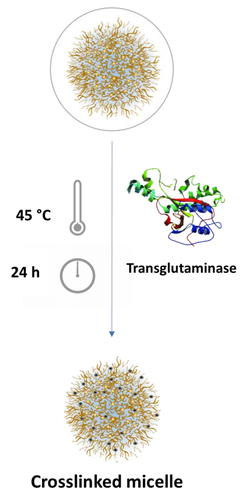
2.0 % ANTHOCYANINS

5.0 % seed ELLAGIC ACID

Polyphenols reduce the risk of disease

Cancer · Cardiovascular diseases · Diabetes · Chronic diseases





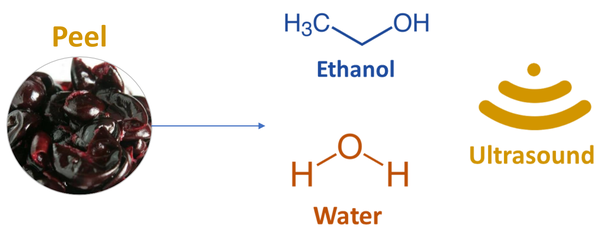
The jabuticaba is a dark berry rich in vitamin C, minerals and phytochemicals (phenols and anthocyanins). These last ones have biological properties including strong antioxidant and anti-inflammatory, anti-diabetic, and anti-obesity properties. The polyphenols are found only in the fruit peel (~50% of fruit), which is not directly edible. Thus, the extraction of anthocyanins and other bioactive compounds from jabuticaba peels is of industrial interest. However, polyphenols originating from jabuticaba are unstable under environmental conditions and their encapsulation is necessary for industrial applications.

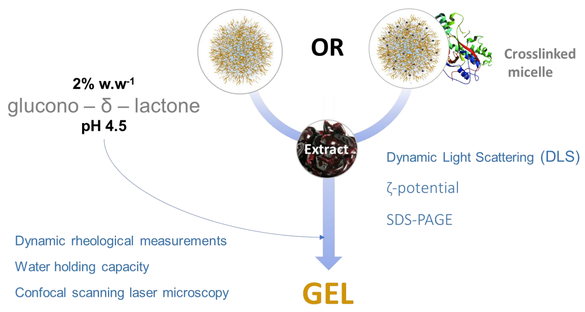
The casein micelles are natural nano-transporters with hydrophobic and hydrophilic binding sites which make favorable the encapsulation of lipophilic and water-soluble compounds. The casein micelles are a renewable resource obtained by industrial techniques of filtration and drying of bovine milk.
Studies have reported that some anthocyanins are able to link to the casein monomers which make the micelles a promising encapsulation agent of polyphenols from jabuticaba fruit. Nonetheless, the caseins are unstable in pH 4.6 and a burst release of polyphenols in the stomach would be expect. Thus, the crosslinking of casein micelles with transglutaminase can make them more resistant to acid pH improving the release of the active at different pH conditions.

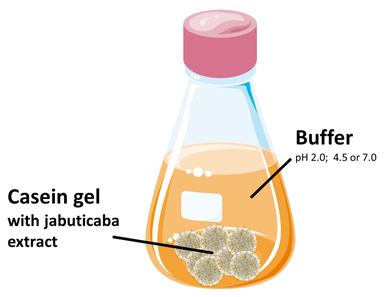
AIM

- To protect the polyphenols from **Jabuticaba extract** against enviromental conditions by encapsulation in crossliked **casein micelles.**
- To promote **prolonged release** of polyphenols at diferente pH values.

METHODS







Jabuticaba peel was placed in an extract solution made of 70% (v/v) acidified ethanol (pH 2.0). The mixture was put under ultrasonic treatment for 10 min. The suspension was concentrated until 10% of the initial volume. A total polyphenol content of 11.64 $g.L^{-1}$ and monomeric anthocyanin content of 8.39 $g.L^{-1}$ were found.

The micellar casein suspension, treated or not with transglutaminase, was added of Jabuticaba extract and evaluated by hydrodynamic diameter (Ø), Zeta potential (ζ) and SDS-PAGE electrophoresis. Micellar casein suspensions added of Jabuticaba extract were put in contact with glucono-δ-lactone to gelation of proteins at pH 4.5. The gels were evaluated by Dynamic rheological measurements, Water holding capacity and Confocal scanning laser microscopy.

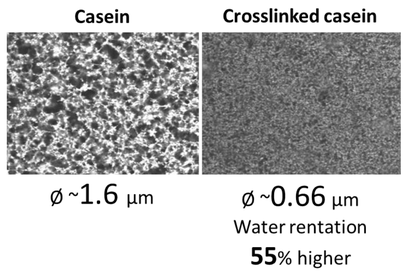
RELEASE PROFILE : The gels were put in contact with buffer pH 2.0 (0.1 M KCl:HCl), pH 4.5 (0.1 M acetic acid: sodium acetate), pH 7.0 (Hepes buffer). Every hour, 600 µL of each supernatant was analysed by differential pH. The release of polyphenols was expressed in percentage.

RESULTS

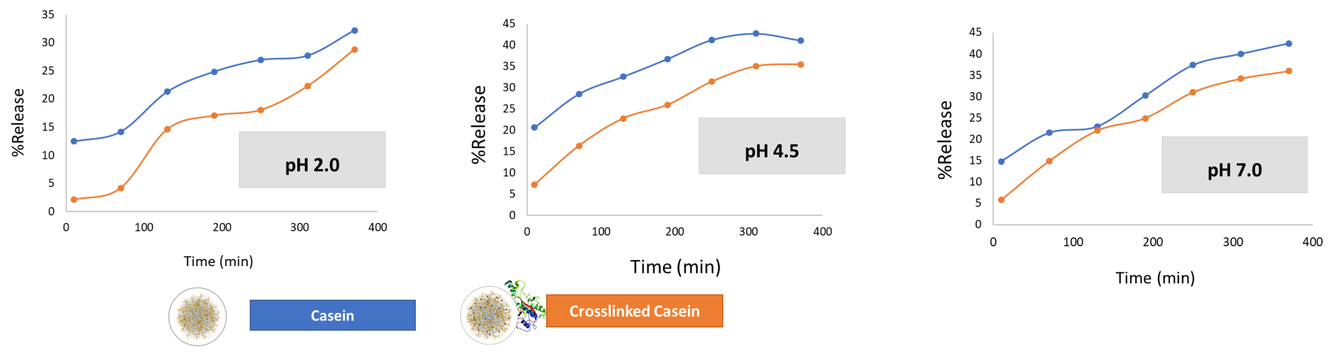
Casein suspesion

The extract has not been altering the casein micelles in suspension. However, the crosslinking decreased the micelle size.

Casein gel

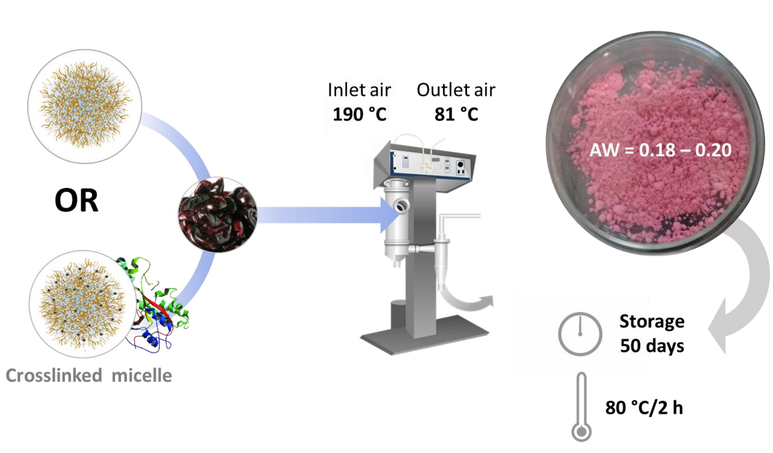


The extract has been altering the porous size and decreased the gel elasticity



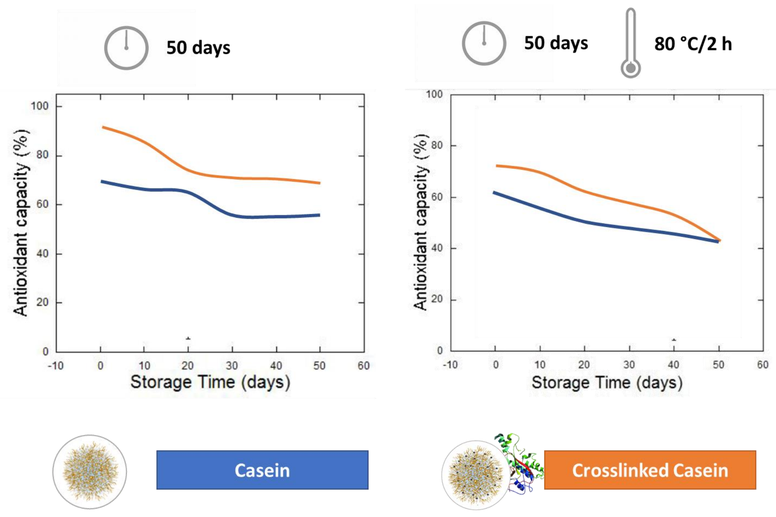
The extract encapsulation in casein micelles has been allowing the prolonged release of the active. The crosslinking has been increasing the release time.

METHODS



The polyphenol extract and the casein micelles, crosslinked or not, were mixed at the molar ratio of 5:1. and, then, spray dried.
Polyphenol extraction from casein micelles was based on the principle that these molecules present more affinity to non-polar solvents than to the proteins . Around 100 mg of the powder samples were diluted into 25 mL of methanol, mixed together and centrifuged at 15000 rpm for 5 min. The supernatant was collected and used for the measure of the antioxidant capacity.
The antioxidant capacity of the samples was determined using 2,2-Diphenyil-1-picrylhydrazyl (DPPH). The DPPH solution was prepared with 0.003 g of DPPH diluted into 50 mL of methanol. Aliquots of 0.5 mL of jaboticaba extract or powder extract were added to 3.5 mL of DPPH solution and the absorbance was analyzed at 517 nm. The antioxidant capacity was used to verify the evolution of the antioxidant potential of the samples during the storage time (0-50 days) and after heat treatment (80 °C/2 hours).

RESULTS



Casein powders with polyphenol extract presented lower value for antioxidant capacity than crosslinked micelles with jaboticaba extract. The resultss show that the crosslinked micelles were effective in maintaining the antioxidant characteristic of polyphenol extract, better than casein and the extract itself (pure).

CONCLUSION

This work showed that crosslinked casein hydrogel can be a good candidate to encapsulate Jabuticaba extract. The polyphenols interact spontaneously with caseins and it is entrapped into micelles. The internal encapsulation of extract did not change the properties of caseins in suspension. However, the extract caused modifications in the protein matrix, which can be attested by rheological measurements and pore size evaluation. Crosslinked casein micelle hydrogel can encapsulate polyphenols without large changes in hydrogel properties. For this reason, this hydrogel can be applied to carry and delivery such compounds. After spray drying, the crosslinked micelles presented higher protection of polyphenols against stress agents such as aging and heat treatment, being a good alternative to encapsulation. This brings about the potential use of this encapsulation agent as functional ingredient for foods or drugs.

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